Summary

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HEPAP meeting

April 26, 2002

Strategic Steps Toward our Scientific Goals

A Multi- Prong Approach

- **Elements of a Roadmap by Topic**
  - The Existing and Near- Term Program
  - Theoretical Physics, Phenomenology and Data Analysis Theory
  - The Energy Frontier Tevatron/CDF/D0 LHC/CMS
  - Lepton Flavor Physics MiniBooNE NuMI/MINOS
  - Quark Flavor Physics CDF/D0 BTeV CKM
  - Unification Scale Physics
  - Cosmology and Particle Physics SDSS CDMS
  - High- Energy Particle- Astrophysics Auger

from Bagger and Barish talk at HEPAP

Ongoing Projects

Project	Total Project Cost	Dates
US-LHC	$110 M	1997-2005
US-CMS	$165 M	1998-2005
NuMI/MINOS	$170 M	1999-2005
CDF + D0 IIb	~$50 M	2002-2005

? The HEP program is increasingly dependent on large projects, apart from a new collider.

Project management

- The new project system for DOE projects has again increased the formality of oversight and the consequences of budget or schedule problems are more severe.
- We need to make sure that our approach to managing projects takes that into account.
  - Although many HEP projects have been on schedule and budget, some others were not.
    - We regularly undertake projects that push the limits of current technology.
  - We now need to set up a project that with high confidence will meet the schedule and cost baselines.
- We have to work hard to build the innovative projects that we need for our science within these guidelines.

Project Management

- We are taking steps to do improve project management.
  - A standing Technical Review Committees for each major project
  - Accelerator Advisory Committee for accelerator improvements
  - A new Office of Project Management led by Ed Temple that will conduct a cost, schedule, and management review before the DOE baselining review and subsequent Lehman reviews
  - New project accounting software

9 Weeks at Fermilab
3/18/02 – 5/25/02

- Major reviews of the entire laboratory program
  - DOE Annual Program Review
  - URA Visiting Committee
  - HEPAP
- Advisory Committees
  - Physics Advisory Committee
  - Accelerator Advisory Committee
- DOE-SC (Lehman) Reviews
  - LHC Operations
  - NuMI
- Director's Reviews
  - CDF/D0 Upgrades
  - NuMI (Primary Beam)
  - NuMI (Everything else)
  - CMS
- NLC
  - Machine Advisory Committee

Theoretical Particle Physics at Fermilab

- The Fermilab theoretical particle physics group has an excellent, broad research program.
  - The accelerator laboratories have a large responsibility for the training of theoretical particle physicists working on physics below the Planck scale.

- They have been active in planning the future.
  - Snowmass — Quigg (DPF co-chair), Lykken (organizing) , Carena, Mackenzie, Kayser (convenors)
  - HEPAP Subpanel — Lykken
  - Run II workshops — many

    (Recent B Physics Workshop report arXiv: hep-ph/021071)

- They play a central part in the intellectual life of the laboratory.

Current Research

? Lattice gauge	Bardeen, Di Pierro, Eichten, Mackenzie, Juge, Kronfeld
? Supersymmetry	Carena, Logan, Nierste, Rainwater
? Perturbative QCD	Ellis, Giele, Leibovich, Parke, Sullivan
? String Theory, D-branes, Extra dimensions	Carena, Lykken, Wang, Hill
? Flavor Physics	Bardeen, Leibovich, Nierste
? Model building	Hill, Wang
? Higgs Physics	Ellis, Logan, Parke, Rainwater
? Neutrino Physics	Barenboim, DeGouvea, Kayser, Parke

Visitor Program

- Frontier Fellows distinguished visitors
  - 2001-2 academic year: Quiros, Gottlieb, Lane, Baur, Braaten
  - Visits range from 3 to 9 months.
- Summer visitors
  - 15 visitors for one month each
- Short term visits, collaborations, and workshop participants
- The Run II workshops benefited greatly from the active participation of these visiting theorists.

Lattice QCD

- A few quantities are known accurately: $?_s$, m_c, m_b.
- Better lattice QCD calculations are needed to extract other Standard Model parameters from experiment:
  - The light quark masses
  - f_B, B_B, f_{Bs}, B_{Bs} → V_{td}, V_{ts}
  - Semileptonic decays → V_{cb}, V_{ub}
- Precise calculations of these quantities are needed to gain the full benefit from the experimental program :
  - BaBar/Belle, CDF/D0, CLEO-C, KTeV/NA48/E949
  - in the future BTeV/LHCb and CKM/KOPIO
- A new generation of computers is needed to make it possible for U.S. physicists to contribute to these advances.

- The High Energy Physics Community should strongly support this effort.

Lattice QCD

- Funded SciDAC proposal:

  National Infrastructure for Lattice Gauge Computing
  - R. Sugar PI
  - 3 labs, many universities
  - Most lattice gauge physicists in the US
- Goals:
  - Common software platform
  - Three Terascale machines
    - Fermilab, JLab commodity clusters
    - Columbia/BNL QCDOC
- 80 Node prototype of Pentium III dual computers was completed here last year.
  - in operation for physics
  - With SciDAC money, bring it up to 256 nodes in FY02, 512 in FY03

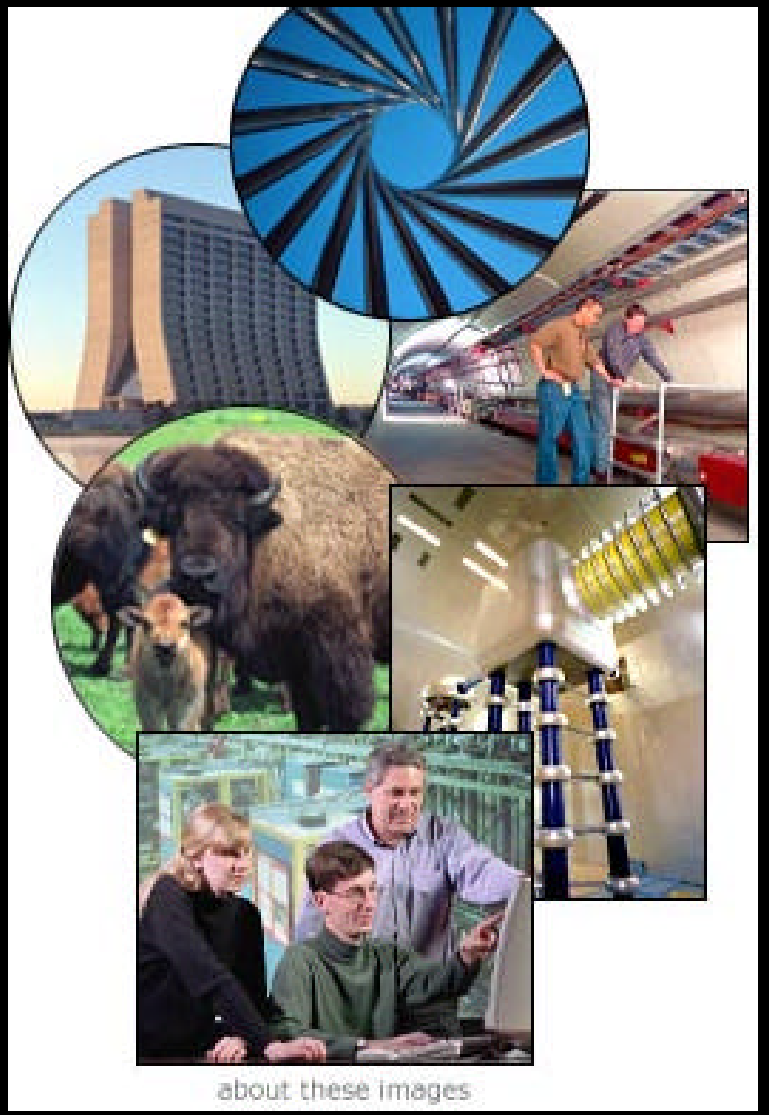
Science Education at Fermilab

- The Lederman Science Education Center is a nationally recognized resource.
  - Over 22,000 students and 8,500 teachers participated in programs.
  - 50 educators and 150 scientists provided program leadership.
  - Friends of Fermilab, Illinois, NSF, & others support programs.
- Saturday Morning Physics classes for high school students
- Summer research programs

- QuarkNet developed into a remarkably successful program in a very short time.
  - It is an extremely good example of NSF-Fermilab collaboration.
- Fermilab acts as host laboratory for QuarkNet.
  - The Spokesperson (Marge Bardeen) and Project Director (Tom Jordan) are located here.
  - Fermilab Run 2 and the Dzero and CDF upgrades are key drivers of the QuarkNet program, providing research work and the prospects for exciting physics for teachers and students.
  - Fermilab hosts the Summer Institutes for lead teachers (a one week intensive/immersive program each June).
  - Fermilab coordinates program review and evaluation.

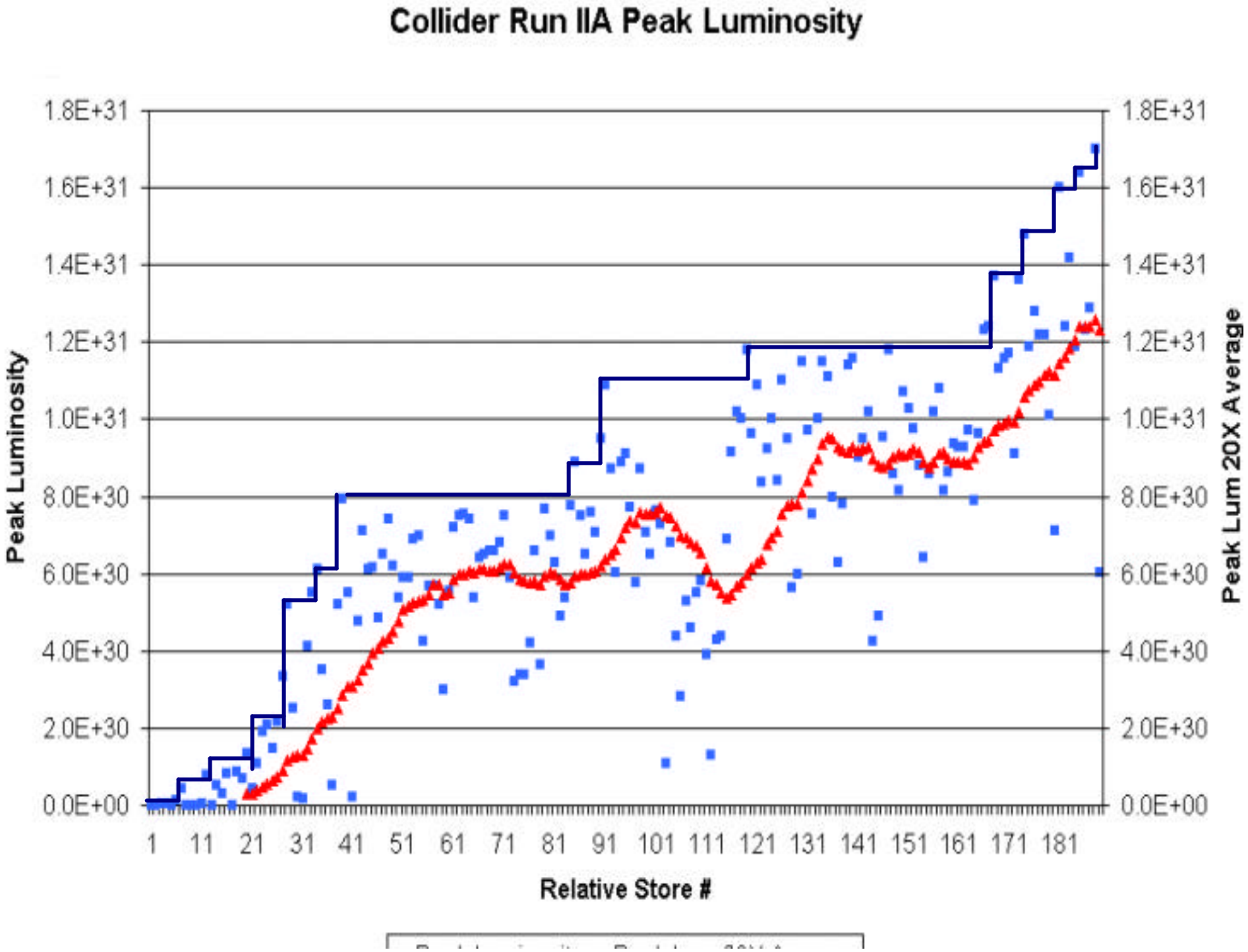
Communication and Outreach

- The HEPAP Subpanel report emphasized the importance of communication and outreach for the field of High Energy Physics.
- HEPAP has recently studied a Communication Commmittee to coordinate these activities
  - Fermilab is host laboratory.
- Fermilab's Office of Public Affairs takes significant responsibility for communication about the field of High Energy Physics.
  - Snowmass
  - meetings of PA officers from international HEP labs



What we need to do in FY 2003

- **Run II**
  - **Keep improving luminosity.**
  - Operate the collider and the experiments efficiently.
  - Keep offline computing capable of handling data production.
  - Make great progress on upgrades.
- **Neutrino program**
  - Keep NuMI/MINOS construction on the new schedule.
  - Operate MiniBooNE efficiently.
- **LHC**
  - Keep US-LHC and US-CMS projects on schedule.
  - Get ready for the physics program.
- **Accelerator R&D**
  - Make good progress, despite budget, on Linear Collider R&D.
  - Keep other programs lean and productive.
- **BTeV & CKM**
  - Do R&D and engineering needed to be ready to start construction, with minimal impact on other programs.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Peak Lum 20X Average
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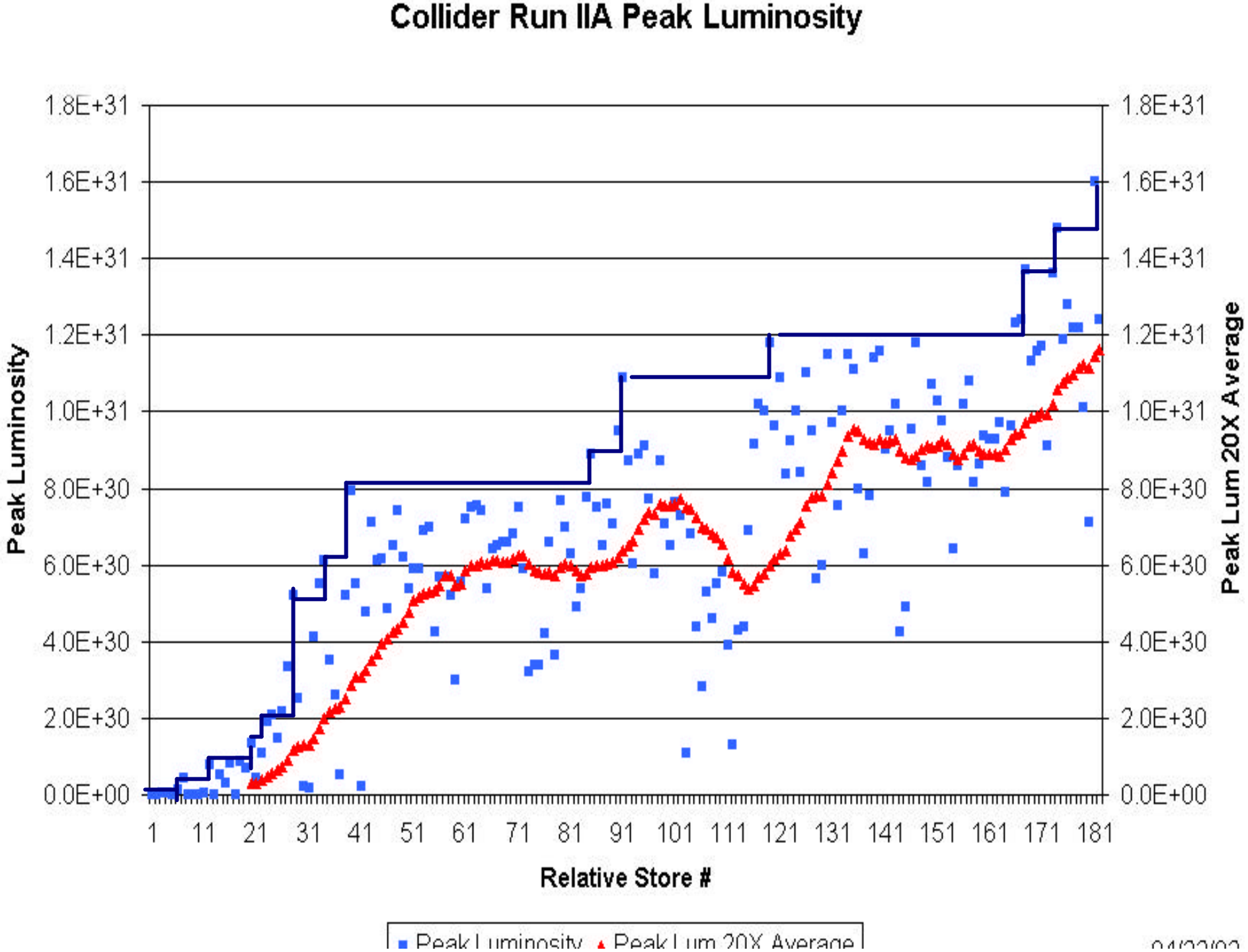
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Summary

- **We have great opportunities for discoveries ahead.**
  - Exploring a new mass region in Run II
  - An excellent program in the fast-moving area of neutrinos
  - Unique experiments in particle astrophysics
  - First look at the TeV scale with LHC
  - Best of class flavor physics with BTeV and CKM

  and
  - Prospects for hosting an international linear collider

  We are working hard on improving collider performance.

The funding for High Energy Physics, and more generally Physics as a whole, is not sufficient to take advantage of the great scientific opportunity.